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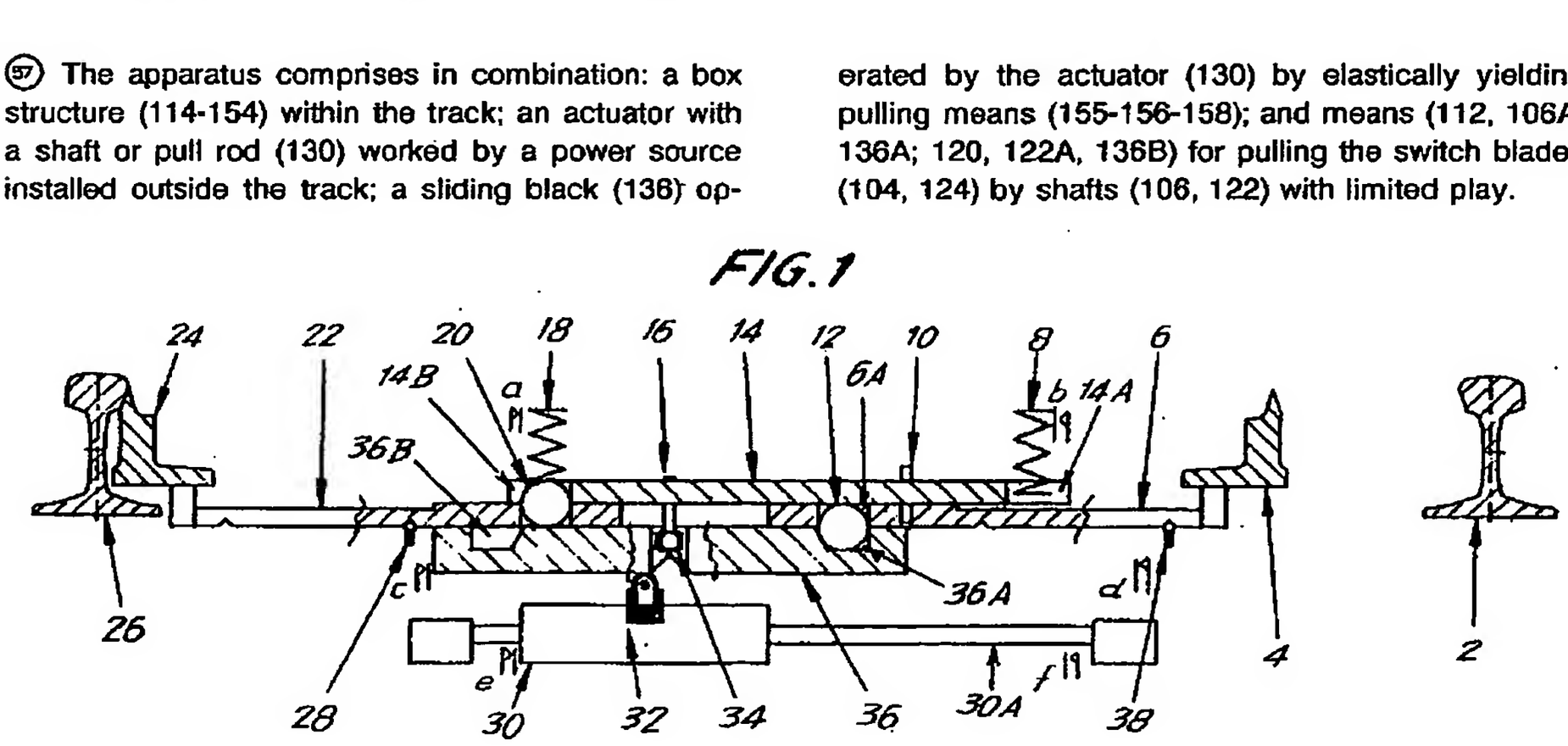
(54) Apparatus for operating the switch blades of railway points.

(57) The apparatus comprises in combination: a box structure (114-154) within the track; an actuator with a shaft or pull rod (130) worked by a power source installed outside the track; a sliding black (136) operated by the actuator (130) by elastically yielding pulling means (155-156-158); and means (112, 106A, 136A; 120, 122A, 136B) for pulling the switch blades (104, 124) by shafts (106, 122) with limited play.

FIG.1



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Boxes for operating the switch blades in railway points are not entirely satisfactory as regards their operation and their intrinsic safety, which are not always able to meet present-day demands. This is well known to those skilled in the art. Moreover, current types of apparatus are mechanically quite complicated and difficult to maintain. These and other defects and disadvantages are avoided with the apparatus according to the invention.

The apparatus according to the invention - for operating the switch blades of railway points - substantially comprises in combination: a box structure within the track; an actuator with a shaft or pull rod worked by a power source installed outside the track; a sliding block operated by the actuator by elastically yielding pulling means; and means for pulling the switch blades by shafts with limited play.

In a practical embodiment the sliding block has recesses with a vertical outward wall and an inclined inward wall; the shafts of the switch blades have passing seats; rollers can be received in said recesses and in said passing seats; and associated with a fixed structure are elastic means able to act on the rollers to prevent their escape from said recesses.

Further characteristics are defined in the enclosed claims.

The invention will be better understood by following the description and attached drawing, which shows a practical non-limiting illustrative embodiment of said invention. In the drawing:

Figs. 1 and 2 show a first embodiment in diagrammatic vertical cross-section and in plan view the position before the switch blades begin to be moved towards the right;

Figs. 3 to 7, in a similar way to Fig. 1, show various successive stages in the movement;

Fig. 8 shows the points being forced open;

Fig. 9 shows the stage of Fig. 8 in plan view;

Figs. 10 and 11 show possible anomalous conditions.

Fig. 12 shows the position in diagrammatic vertical section before the switch blades begin to be moved towards the left when viewing the drawing, in a second embodiment;

Figs 13 to 17 show the various successive stages of the movement;

Figs 18 and 19 show the stage of forcing the points open;

Figs 20 and 21 show two different abnormal conditions;

Fig. 22 shows a partial exploded perspective view;

Fig. 23 shows a partial enlargement of Fig.12;

Fig. 24 shows a diagram of points;

Figs 25 and 26 show the cross-section and plan of a stage of end-of-travel to the right when viewing the drawing;

Figs 27 and 28 show in a similar way to Figs 25 and 26 a stage of pulling to the left when viewing the drawing;

Fig. 29 shows a longitudinal section through planes marked X-X and Y-Y in Fig. 30;

Figs 30 and 31 are cross-sections through XXX-XXX and XXXI-XXXI in Fig. 29; and

Figs 32 and 33 show two perspective views of a component illustrated in isolation.

In Figs. 1-11, 2 indicates one stock rail and 26 the other stock rail. The switch blade 4 can interact with the stock rail 2 and the switch blade 24 interacts with the switch blade 26. The switch blade 24 is fixed to a shaft or pull rod 22, at a thickened end of which it has a seat 22A for a roller 20. The switch blade 4 is fixed to a shaft or pull rod 6 which likewise forms a seat 6A for a roller 12. A fixed structure 14 forms two housings 14A and 14B, with which springs 8 and 18 are associated to exert a downward thrust. On the fixed structure 14 run two retaining pins 10 and 16 which are for restraining a trolley 34. 36 indicates a sliding block that has two cavities 36A and 36B each having a vertical outward wall and an inclined inward wall; the rollers 12 and 20 are able to interact with the two cavities 36A and 36B. The sliding block 36 has a dihedral seat - on the side in the drawing (Fig. 2) - with which an elastic roller-type peg belonging to the trolley 34 interacts; able to interact with another dihedral seat - lower down in the drawing - on the sliding block 36, is an elastic roller-type peg 32 belonging to an actuator 30, which runs along fixed aide means 30A. 28 and 38 indicate elastic stabilisers for the switch blades at their end of travel.

Electrical controls are provided to detect various conditions, among these being: contacts a and b for the position of the rollers 20 and 12 respectively when entering the housings 14B and 14A; contacts c and d to detect the presence at end-of-travel of the sliding block 36; contacts e and f to detect the ends of travel of the actuator 30.

At the start of the operation to move the switch blade 4 (and then 24) to the right, the actuator 30 leaves the position of Fig. 1 and, after releasing the trolley 34 by lifting the pin 16, engages the sliding block 36 with the peg 32; thus, through the roller 12 and the pull rod 6, the sliding block (Fig. 3) begins to move the switch blade 4; at the start of the translational movement, as the space R is cancelled out, that is as the overlap R is eliminated (Fig. 4), the roller 20 finds the cavity 36B and enters it owing to its own weight and the stressing of the spring 18, so that the sliding block 36 becomes fixed - by the roller 20 - to the pull rod 22, so triggering the pulling of the switch blade 24

as well. The released trolley 34 is pulled along with the sliding block 36 without braking its motion since it is engaged by its elastic roller in the dihedral seat at the side of the sliding block. The various electrical contacts C pick up the movement of the sliding block 36. When the switch blade 4 reaches and bears against the stock rail 2 (Fig. 5) the roller 12, being unable to advance any further, is stressed by the inclined wall of the cavity 36A to rise, so forcing the spring 8 and entering the area 6A; this achieves the "throwing over" of the points, monitored electrically, too, by the contact b, while the sliding block 36, continuing its movement towards its limit switch d, continues to pull the switch blade 24 and brings about the offset R1 between the roller 12 and the cavity 36A, that is creates the "overlap" R1 (Fig. 6).

When the sliding block 36 has reached the limit switch d, the actuator 30, overcoming the load of the spring of the elastic peg 32 and therefore putting out its maximum pulling effort, disconnects itself from the sliding block 36 (Fig. 7) and, before ending its operation on the limit switch f, causes the pin 10 to become fixed to the trolley 34. The purpose of this operation is shown in Fig. 8 where the "forcing open" of the points is shown. If, in the condition of Fig. 7, the switch blade 24 were forced towards the stock rail 26 (as indicated by the arrow in Fig. 8), the roller 20 would transmit the force to the sliding block 36 which in order to move must overcome the load created by the trolley 34, which is locked - as already stated - by the pin 10. If such a situation arises, the sliding block, having overcome the pre-established load, cancels the space R1, that is eliminates the overlap R1, engages the roller 12, the pull rod 6 and the switch blade 4, allowing the system to come to the position of points forced open (Fig. 8). The combination of the sliding block 36 and the trolley 34 - with the dihedral seat of the sliding block 36 and the elastic roller-type peg of the trolley 34 - gives a profile that can recover the travel over pre-established limited values. The electrical controls d would indicate the "forcing open" of the points.

Fig. 9 shows the trolley 34 disconnected.

Fig. 10 shows an anomaly arising when the points are operated and the stock rail 2 is not found in the right position. In this case - owing to a lack of resistant force on the assembly 6, 4 from the stock rail 2 - the roller 12 is not compelled to come up, compressing the spring 8, does not achieve the throw-over, and the electrical contact b is not therefore activated. The electrical controls which will be affected by the successive events carried out at the end of the operation, are thus in a condition to indicate the anomaly. The system is therefore not point-locked.

In the case of a foreign body CE being interposed between the switch blade 4 and the stock rail 2 (Fig. 11), the actuator 30 starting from the condition of Fig. 4, disconnects itself, after putting out its maximum pulling load, from the sliding lock 36 and carries on to its end-of-travel without the limit switch d being previously affected. Since the operation has not been completed properly, the throwing over of the points, with the lifting of the roller 12, does not occur here either, and therefore in this case too the system is not point-locked, and the electrical controls indicate this condition.

The elastic retaining pegs 28 and 38 have the function of stabilising the switch blades in position at the end of the operation by interacting with corresponding cavities formed, for example, in the shafts or pull rods 22 and 6.

With these arrangements, advantages are achieved that are obvious from reading the text; among other things the levels of safety of operation are achieved that are needed in practice, purely by linear movements, without pulleys and practically without articulations, and with a drastic reduction in the number of parts, possible alterations to which will not prejudice safety.

In Figs. 12 to 23, 102 and 126 indicate the two stock rails, with which the switch blades 104 and 124 respectively can interact alternately. Fixed to the switch blade 104 is a shaft 106 provided with a seat 106A for a roller 112; fixed to the switch blade 124 is a shaft 122 provided with a seat 122A for a roller 120. The fixed structure of the box comprises a part 114 and two components 154 each of which has two access seats 154A and 154B, into which rollers 150 and 151 respectively can be partially received. 136 indicates a sliding block that has two walls 136X defining a lower depression 136Y; in this depression 136Y a cavity 136Z is formed with a partial cylindrical surface. On the top of the sliding block 136 are two symmetrical cavities 136A and 136B with inward lateral access wall. Underneath, at the sides of the cylindrically surfaced cavity 136Z are two seats 136D, and two outward walls 136C. 130 indicates the shaft or pull rod of an external actuator 131, intended to work the movements of the switch blades. Fixed to the shaft or pull rod 130 are two lateral forks 152 and 153, capable of movements inside the depression 136Y of the sliding block 136, between the walls 136X. On the shaft 130, two cups 155 and 156 are slidably mounted facing each other, and contained between them is a compression spring 158 that tends to hold them apart; the two cups are partially housed within the cavity 136Z. Fixed to each of the cups 155 and 156 is a pair of wings 155A and 156A respectively, being symmetrical about the corresponding cup and forming passing seats for the abovementioned rollers 150 and 151 respectively. Interacting with the shaft 130 is, among other

things, an elastic peg 138 to stabilise the position of the shaft. The fixed part 114 has two seats 114A and 114B for receiving the rollers 112 and 120; associated with said seats 114A and 114B are push springs 108 and 118 respectively for the rollers 112 and 120.

The actuator 131 for the shaft 130 comprises a carriage pulling system 162 worked by a motor 164 through a pinion 164A and a rack 162A; the carriage 162 has an elastic pin 162B which interacts with a seat 130A in the pull rod 130. 170A and 170B indicate two limit switches for the carriage system 162. Figs 25 and 26 show the end of travel to the right when viewing the drawing: the elastic peg 162B of the carriage pulling system 162 has disengaged itself from the seat 130A in the pull rod 130; when the carriage 162 comes into contact with the switch 170A, the motor 164 is stopped and prepared for the reverse operation. Figs 27 and 28 show an intermediate position in the stage of pulling to the left when viewing the drawing; the carriage 162 has engaged with the peg 162A in the seat 130A of the shaft or pull rod 130, as a result of which the pulling system moves the shaft 130 in the direction f130; this movement will end when the switch blade, by reaching the end-of-travel position, compels the unit 162, 162A to disconnect from the shaft 130 and to carry on until it works the switch 170B which - in the same way as described above for the switch 170A - will cut off the motor 164.

With reference to the movements imparted to the shaft or pull rod 130 - as indicated above - the working of the members of the box 114 for switch blade operation will now be described.

In the position of Fig.12, the switch blade 124 is against the stock rail 126 and the shaft 122 of the switch blade is engaged by the roller 120, which is between the seat 122A and the seat 114B. The pull rod 130 is held by the stabilising peg 138.

At the start of the operation, the shaft or pull rod 130 leaves the position of Fig.12 and, moving in the direction of the arrow f130 of Fig.13, pulls the forks 152 and 153 - which are symmetrical with each other and fixed to the shaft - thereby enabling: on the one hand, the rollers 150 which in the position of Fig.12 were retained by the fork 152 in the seats 154A of the components 154 fixed to the structure of the box to be released; and on the other hand to engage, with the fork 153, the rollers 151 contained in the corresponding eyelets of the wings 155A of the cup 155.

Said rollers 151 (Fig.14) transmit the movement of the shaft 130, through the tooth of the shoulder 136C, to the sliding block or drawer 136, which thereby moves in the direction f130, allowing movement by the cup 156 and rollers 150 as well, without loading the spring 158.

The movement of the sliding block 136 (Fig.13) causes, through the roller 112 and the pull rod 106, the switch blade 104 to move and at the same time cancels the offset R3, that is removes the overlap R3 (Fig.13) between the roller 120 and the seat 136B and allows the roller 120 to slip into the seat 136B of the sliding block 136, thereafter enabling the sliding block 136 also to pull the pull rod 122 and the switch blade 124 (Fig. 15).

When the switch blade 104 reaches and bears against the stock rail 102 (Fig.16), the roller 112, being unable to advance any further, is stressed by the inclined wall of the cavity 136A to rise, forcing the spring 108, and entering the seat 114A of the fixed part 114; in this way the points are "thrown over", i.e. the bearing and thrusting of a specific length of the switch blade 104 on the stock rail 102 with the reaching of a specific position of the switch blade, while the sliding block 136, continuing its travel (Fig. 17), continues to pull the switch blade 124 and creates the offset R1 between the roller 112 and the cavity 136A, that is brings about the overlap R1. In this way the rollers 151 enter the seats 154B of the fixed parts 154 and are trapped by the fork 153. In this way the sliding block or drawer 136 is held in position by the cup 155 which in turn is trapped by the rollers 151 on the fixed part of the box, comprising the components 154. The elastic peg stabilising system 138 holds the pull rod 130 in the end-of-travel position (Fig.17) opposite to that illustrated in Fig. 1.

Figs 18 and 19 show the stage in which the points are forced apart. If the switch blade 124 is forced towards the stock rail 126 (as indicated by the arrow fT in Fig. 18) the roller 120 transmits the force to the sliding block 136 which, by moving, after overcoming the resistance of the elastic stabilising peg 138 of the pull rod 130, compresses the spring 158 (Figs 18 and 19), because the cup 155 is held in position by the rollers 151 engaged in the seats 154B of the fixed components 154. After the right amount of travel - to which a specific effort corresponds - the sliding block 136 cancels the space R1 (Fig.17), engages the roller 112 and thus the pull rod 106 and the switch blade 104, and releases the rollers 151 which come up (Fig.19) into the seats 136D. As the effort of the spring 158 then closes on the sliding block 136, the switch blades 104 and 124 become free to slide, enabling the points to be forced apart, with the spring 158 compressed to a limited degree.

Fig. 20 shows an anomaly arising when the points are operated and the stock rail 102 is not found in the right position. In this case, owing to a lack of resistant force on the assembly 106, 104 from the stock rail 102, the roller 112 is not compelled to come up into the seat 114A compressing the spring 108, and does not achieve the throw-over. The pull rod 106 will be stopped against the

fixed part of the box 154 at the point 106B (Fig.20) preventing the sliding block or drawer 136 from continuing its travel.

Fig. 21 shows the interposition of a foreign body CE between the switch blade 104 and the stock rail 102. In this case, after applying its maximum pulling load, the pulling system of the pull rod 130 actuator disconnects itself as already stated, and disconnects the motor from the pull rod.

Suitable electrical contacts will determine whether the sliding block 136 has reached its end of travel, thereby signalling normal functioning, point-forcing and any abnormal cases as described above. An example of possible limit switches is indicated by fc; these limit switches fc interact with the sliding block 136 at the end of its movement in one direction or the other.

The spring 158 may be replaced by a rigid distance piece, for example tubular, to avoid the possibility of a mutual elastic approach between the two cups 155 and 156.

Claims

1. Apparatus for operating the switch blades of railway points, characterised in that it comprises in combination: a box structure (14; 114; 154) within the track; an actuator with a shaft or pull rod (30; 130) worked by a power source (164) installed outside the track; a sliding block (36; 136) operated by the actuator (30; 130) by elastically yielding pulling means (32-155-156-158); and means (112, 106A, 136A; 120, 122A, 136B) for pulling the switch blades (4, 24; 104, 124) by shafts (6, 22; 106, 122) with limited play.

2. Apparatus according to Claim 1, characterised in that the sliding block (36; 136) has recesses (36A, 36B; 136A, 136B) with a vertical outward wall and an inclined inward wall; in that the shafts (6, 22; 106, 122) of the switch blades (4, 24; 104, 124) have passing seats (6A, 22A; 106A, 122A); in that rollers (12, 20; 112, 120) can be received in said recesses (36A, 36B; 136A, 136B) and in said passing seats (6A, 22A; 106A, 122A); and in that associated with a fixed structure (14; 114) are elastic means (8, 18; 108, 118) able to act on the rollers (12, 20; 112, 120) to prevent their escape from said recesses (36A, 36B; 136A, 136B).

3. Apparatus according to Claim 1 or 2, characterised in that interacting with the sliding block (36) is the elastic peg of a trolley (34) which can be locked by pegs (16, 10) and be disconnected from their actuator (30).

4. Appparatus according to one or more of the preceding claims, characterised in that it comprises position sensors (c, d) for the sliding block (36); position sensors (e, f) for the actuator (30); and position sensors (a, b) for the rollers (20, 12); said sensors being able to give permission for various moves in sequence.

5. Apparatus according to Claim 1 or 2, characterised in that the shaft (130) has crosspieces (152; 153); in that the sliding block (136) has a cavity (136Z) to partially receive two cup-shaped members (155, 156) or the like, engaged on said shaft (130) between the said two crosspieces (152; 153); in that said two members (155; 156) form passing seats for rollers (150, 151) able to interact with said crosspieces (152; 153) and with seats (154A; 154B) in the fixed box, into which the rollers (150; 151) can be stressed by the crosspieces (152; 153); and in that in the sliding block (136) itself stops (136C) are formed, on which the rollers (150; 151) act to push said sliding block by the action of the shaft (130).

6. Apparatus according to Claim 5, characterised in that said cup-shaped members (155; 156) or the like are elastically stressed apart by a spring (158) to bear against the ends of the cavity (136Z), and in that cavities (136D) having inclined walls are provided in said sliding block (136) to partially receive said rollers (150; 151) in the forcing apart of the points, with disconnection from the corresponding roller (150, 151) which is released from the corresponding seats (154A; 154B) of the components (154) fixed to the box.

7. Apparatus according to Claim 5, characterised in that said cup-shaped members (155, 156) or the like are held rigidly apart from each other, for an embodiment in which the points cannot be forced open, by means of a tubular distance piece or the like.

8. Apparatus according to one or more of claims 5 to 7, characterised in that said cup-shaped members (155, 156) or the like have wings (155A, 156A) with passing seats for said rollers (150, 151), said wings and said rollers interacting with the crosspieces (152, 153) of the shaft (130), which crosspieces extend at right angles to stress and release said rollers.

9. Apparatus according to one or more of claims 5 to 8, characterised in that said shaft (130) for the actuator is engaged with elastic peg means with a carriage pulling system (162) or the like,

to allow overtravel by said system to prepare for the reversing of the motion of the power unit (164) by means of a switch (170A; 170B).

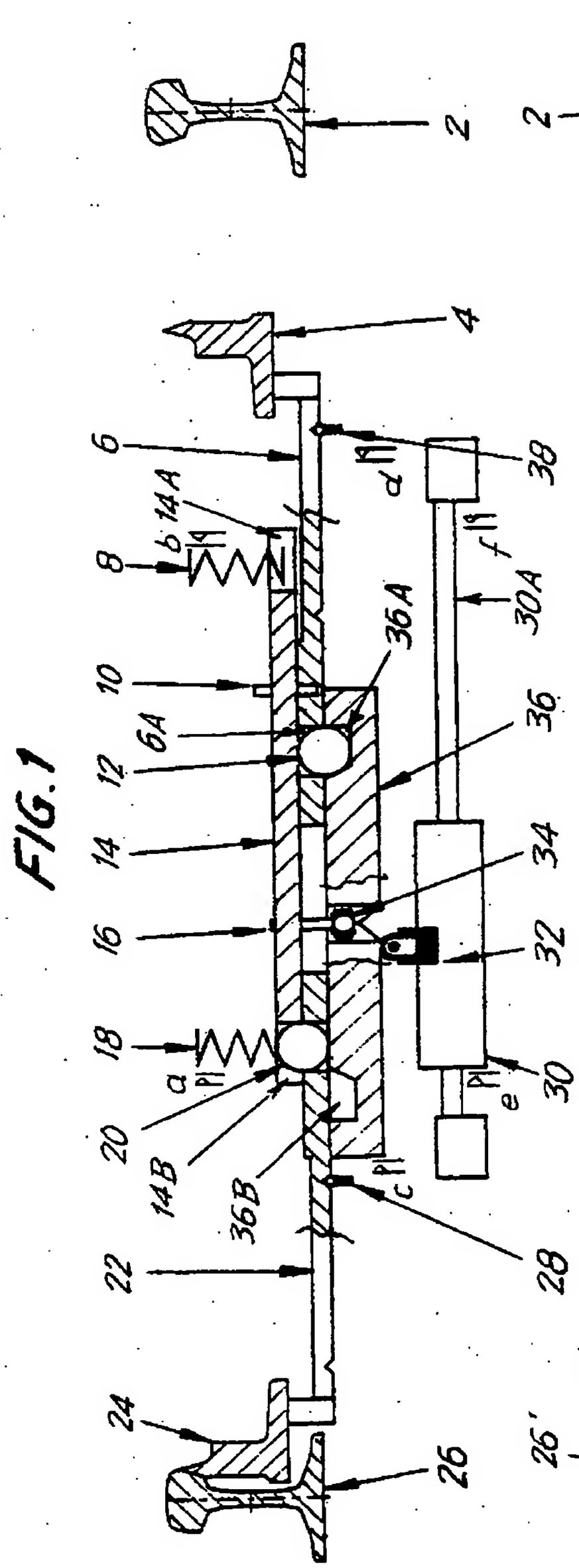


FIG. 1

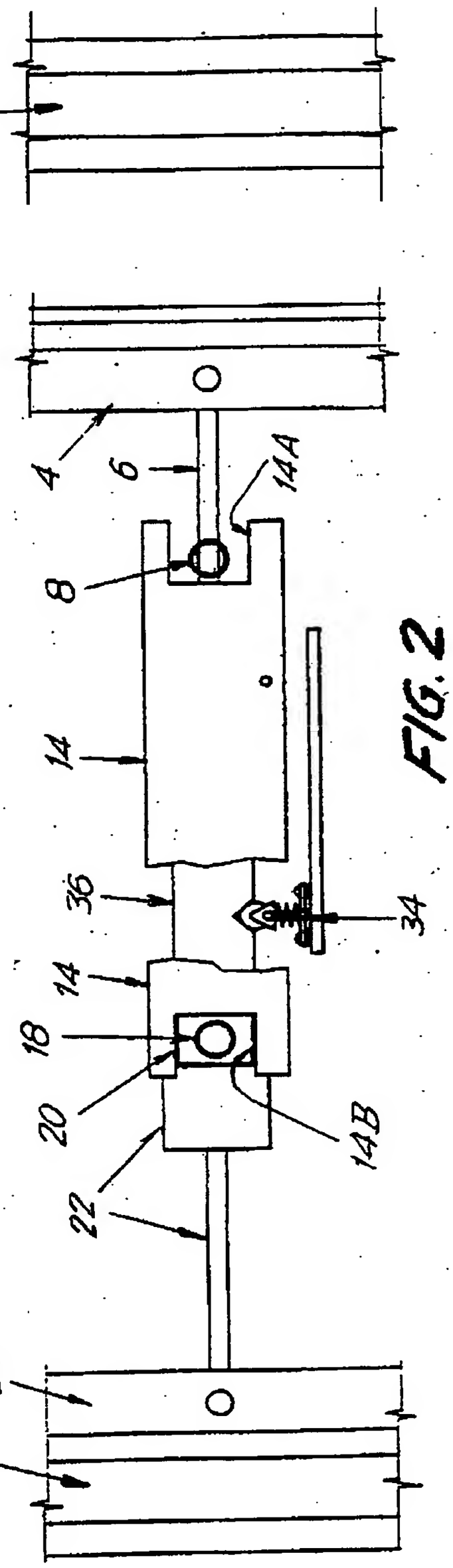
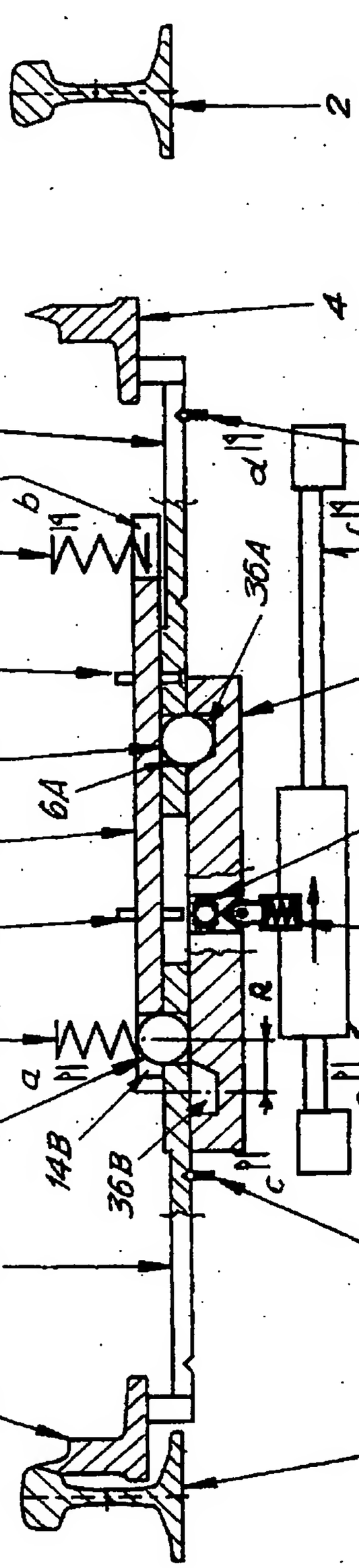


FIG. 2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b
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14
16
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14B
36B
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28
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d
38
30A
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R

FIG. 3

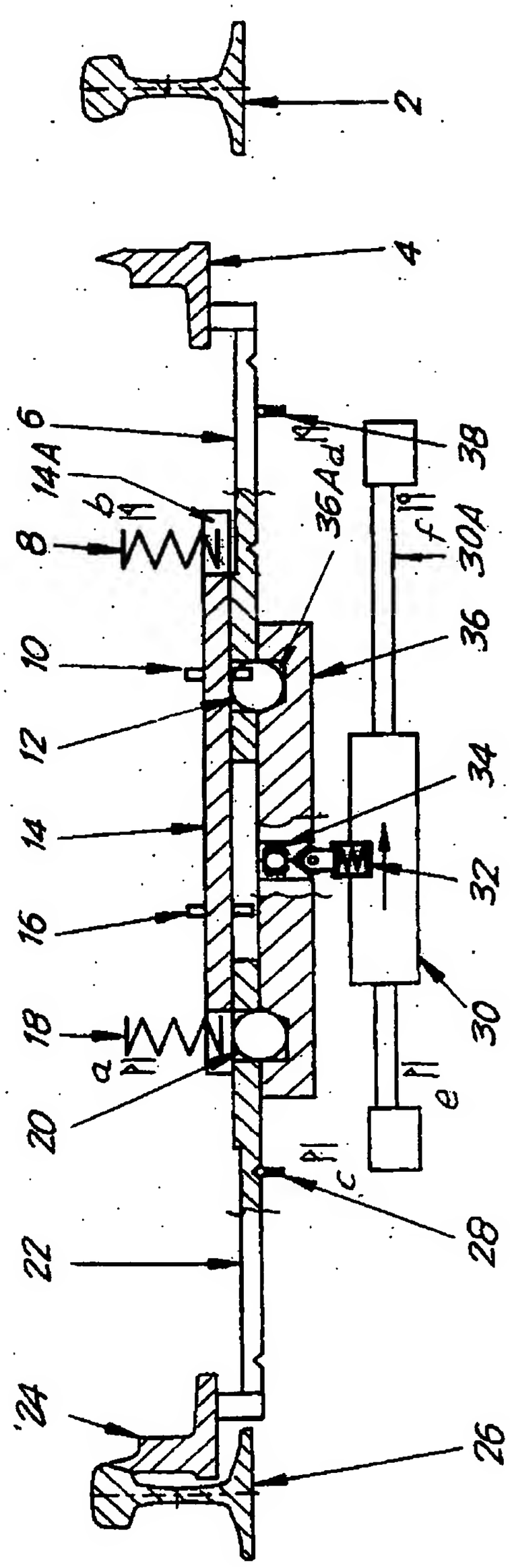
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FIG. 4

FIG.5

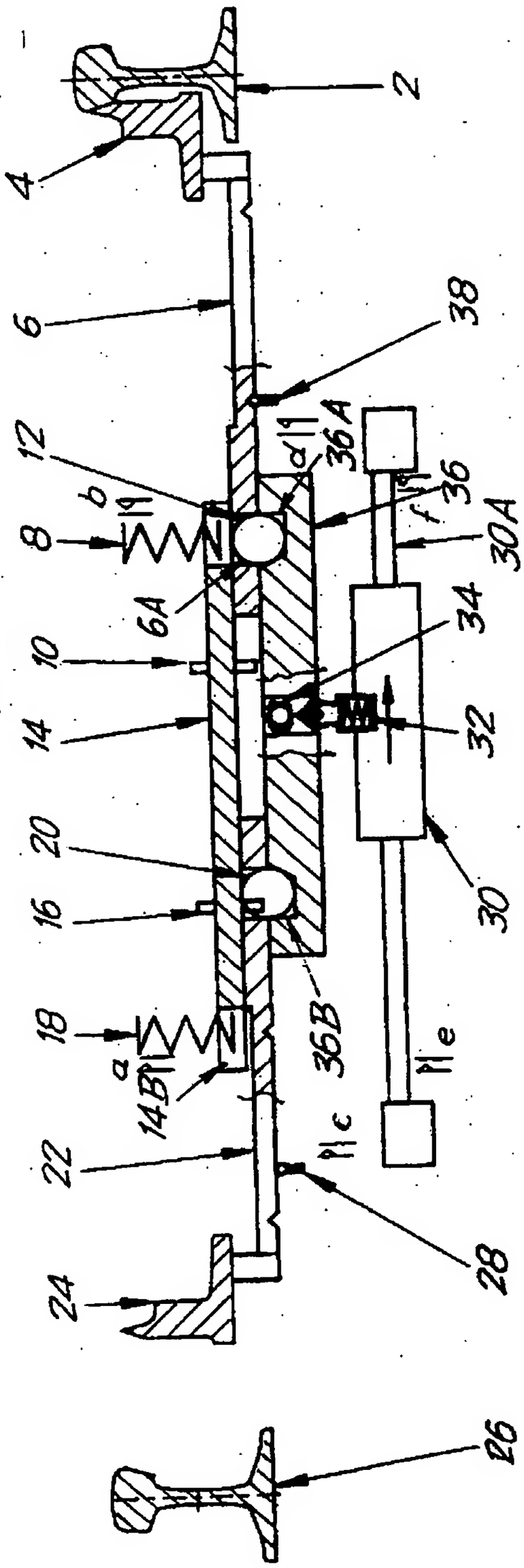
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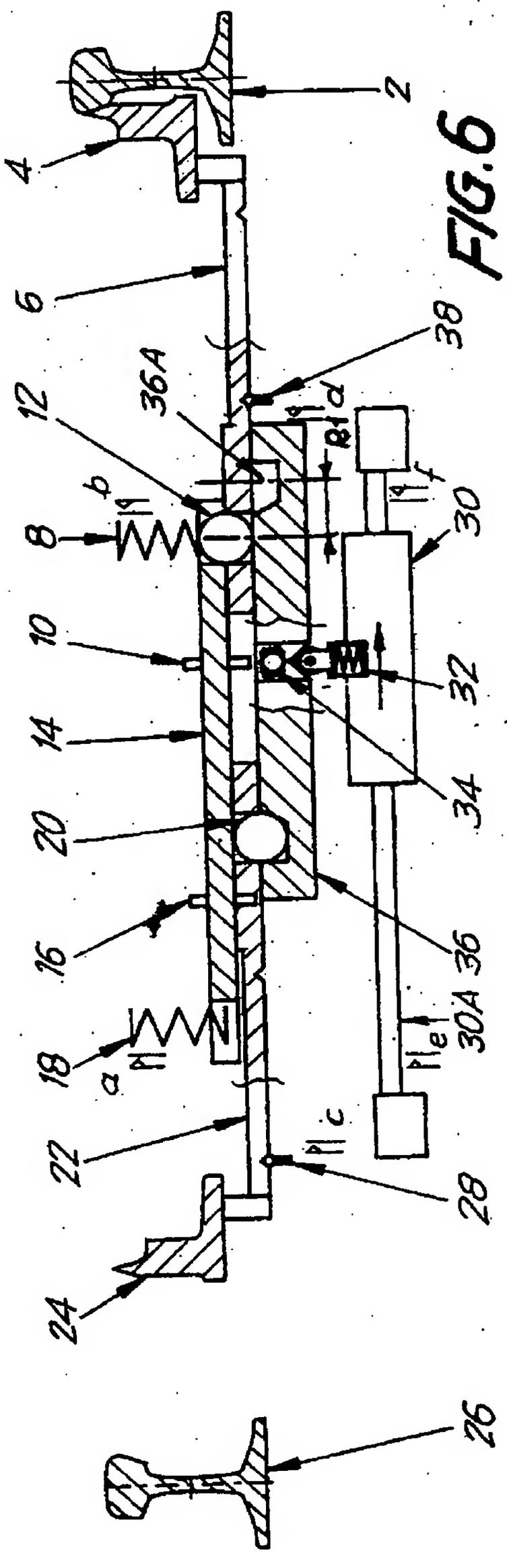
FIG.6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Pc
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FIG. 7

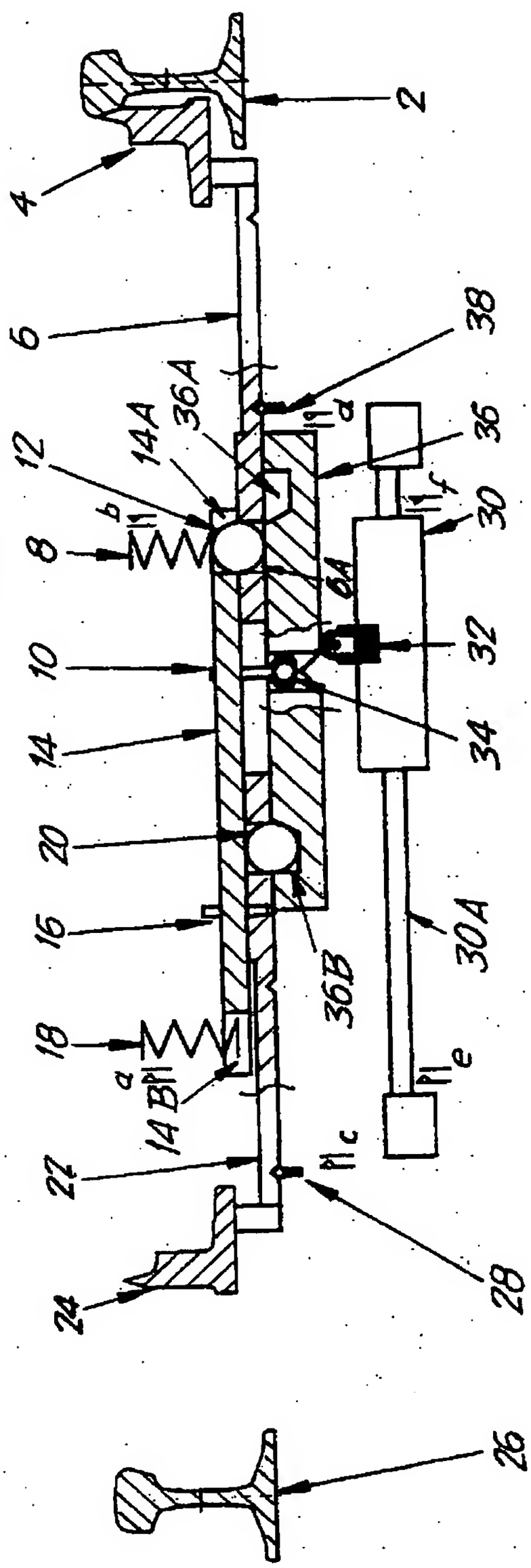
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FIG. 8

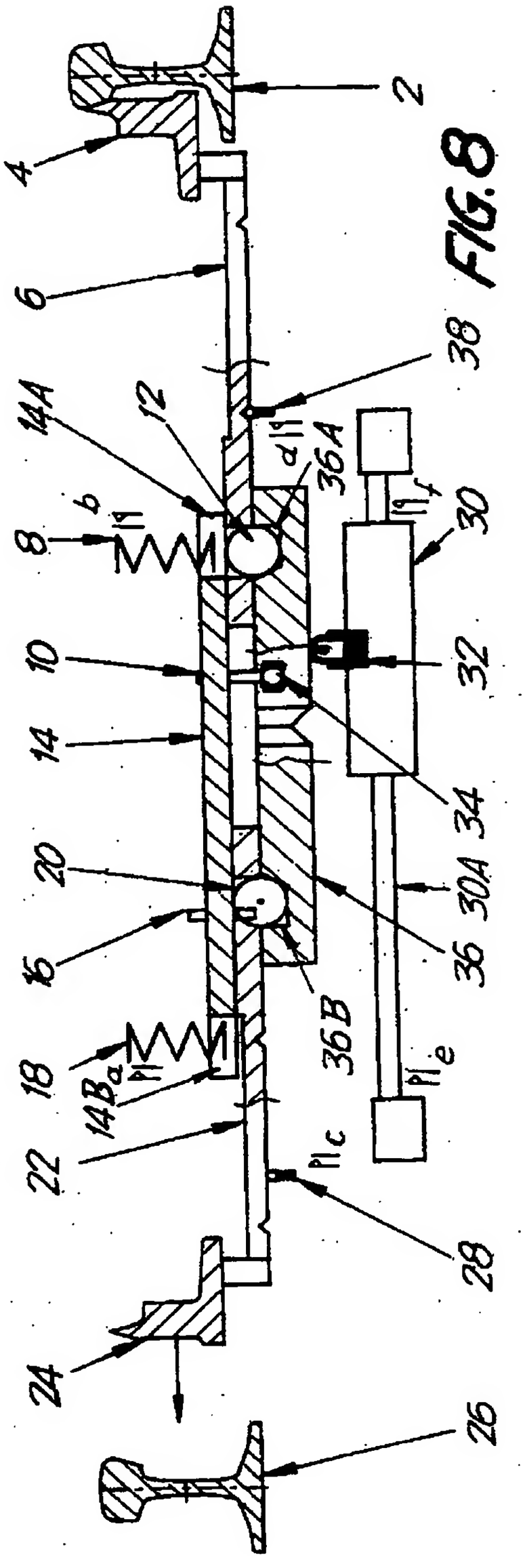
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FIG. 9

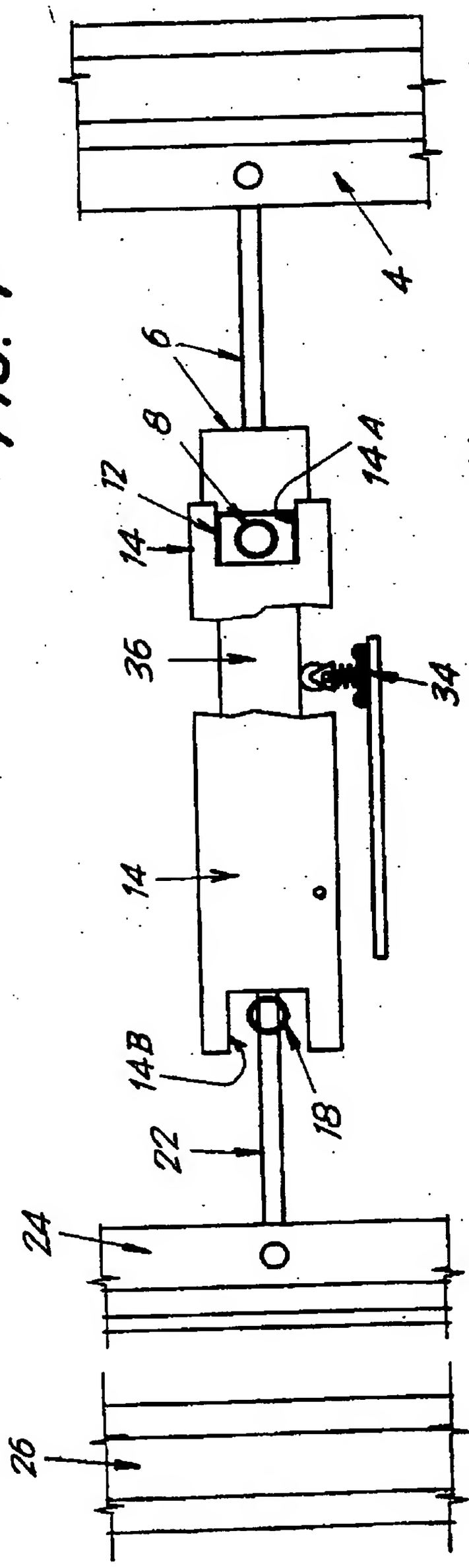
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FIG. 10

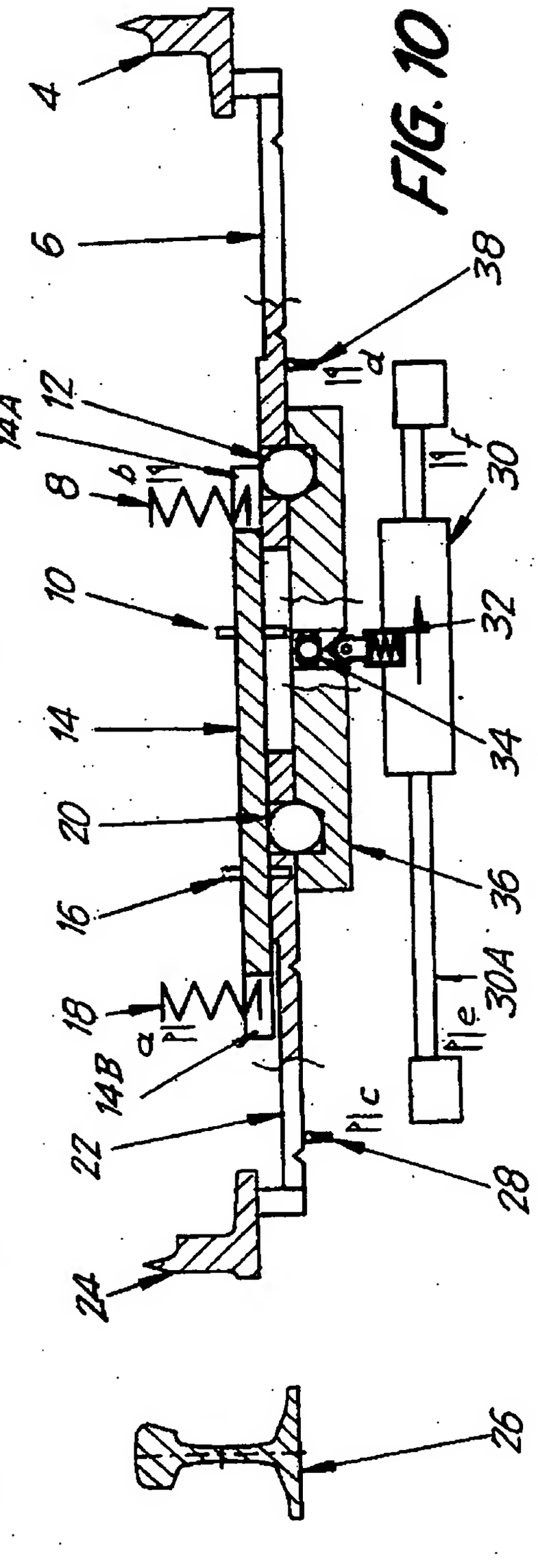
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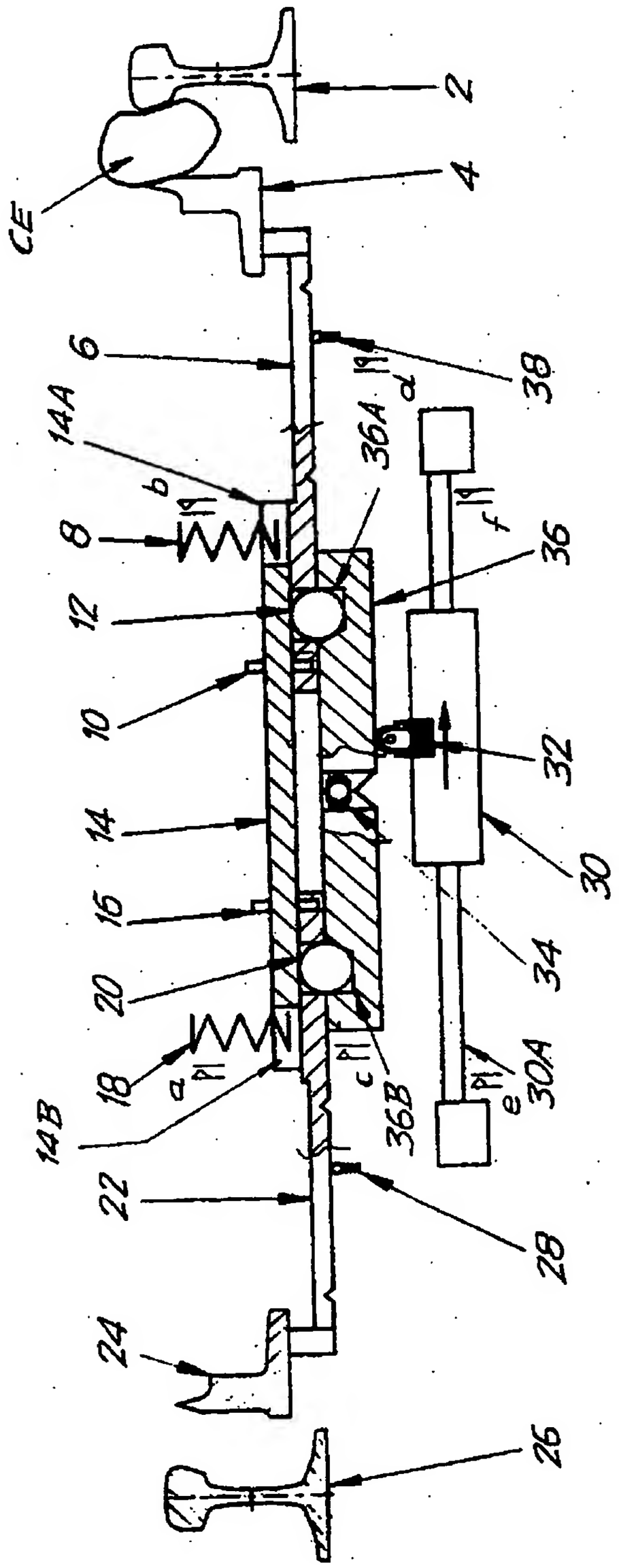
FIG. 11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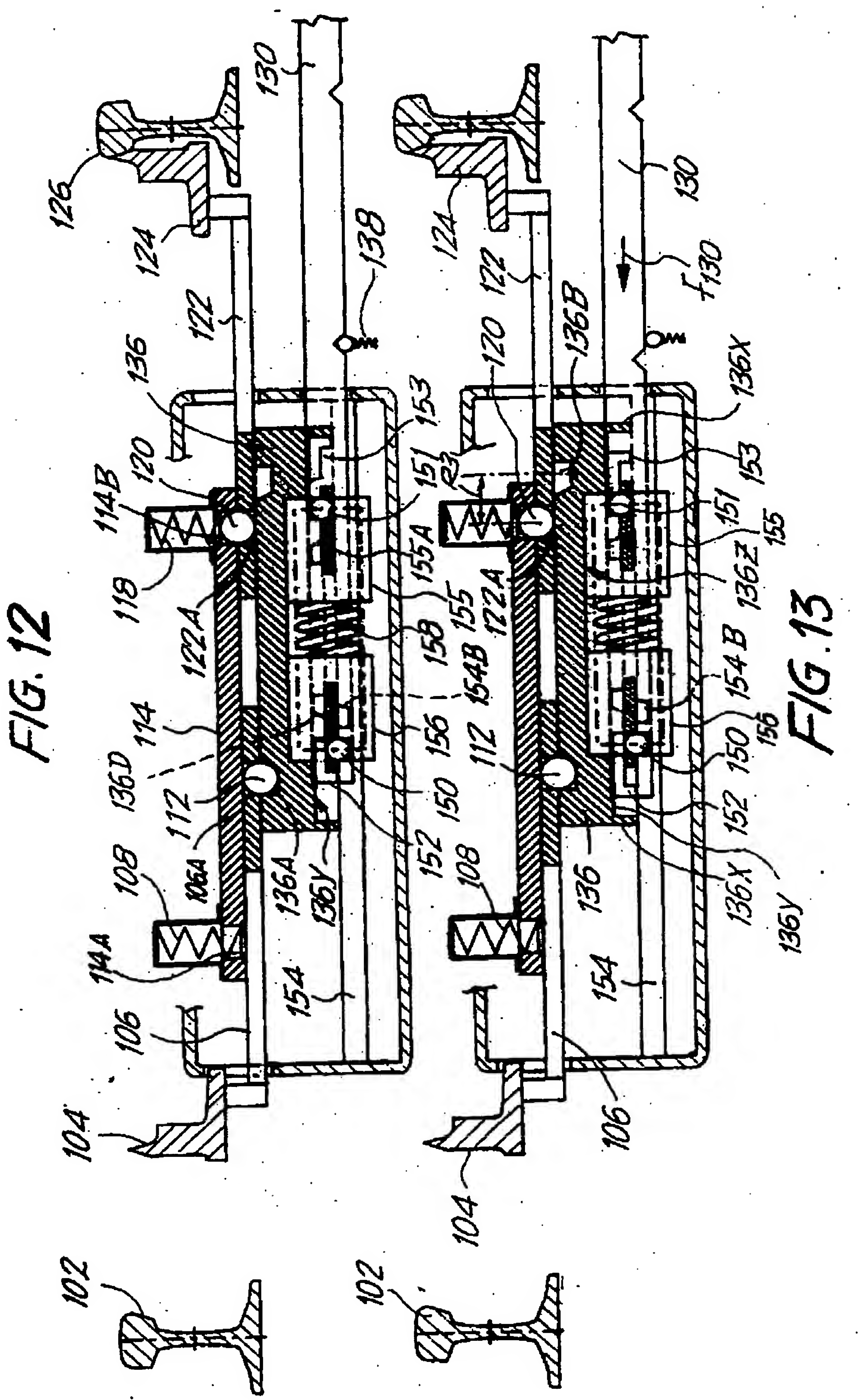
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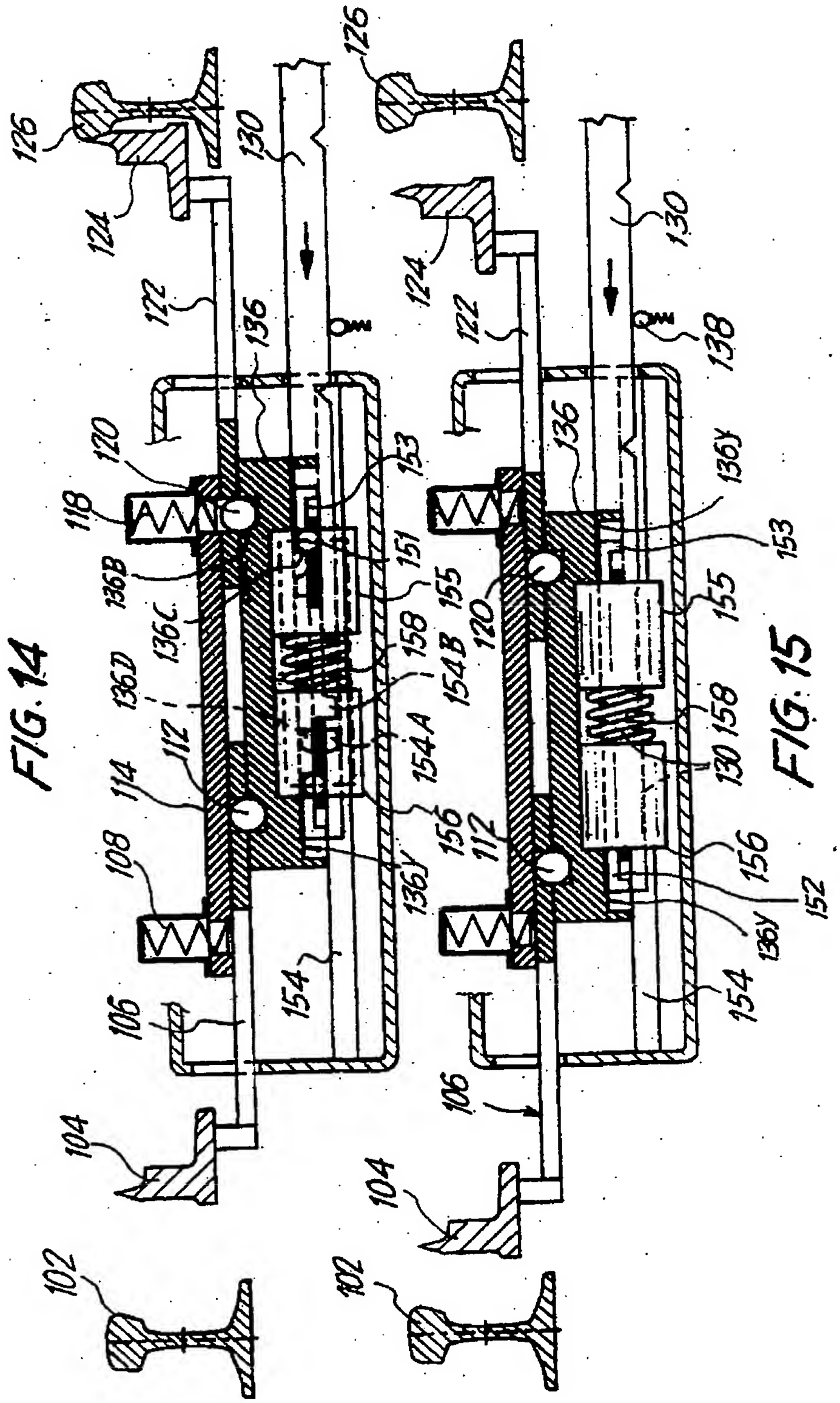
FIG. 12

FIG. 13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151
136C
158
136D
154A
112
114
156
108
136Y
154
106
104
102
126
130
124
122
138
136
136Y
153
155
120
154B
158
130
156
112
152
154
106
104
102

FIG. 14

FIG. 15

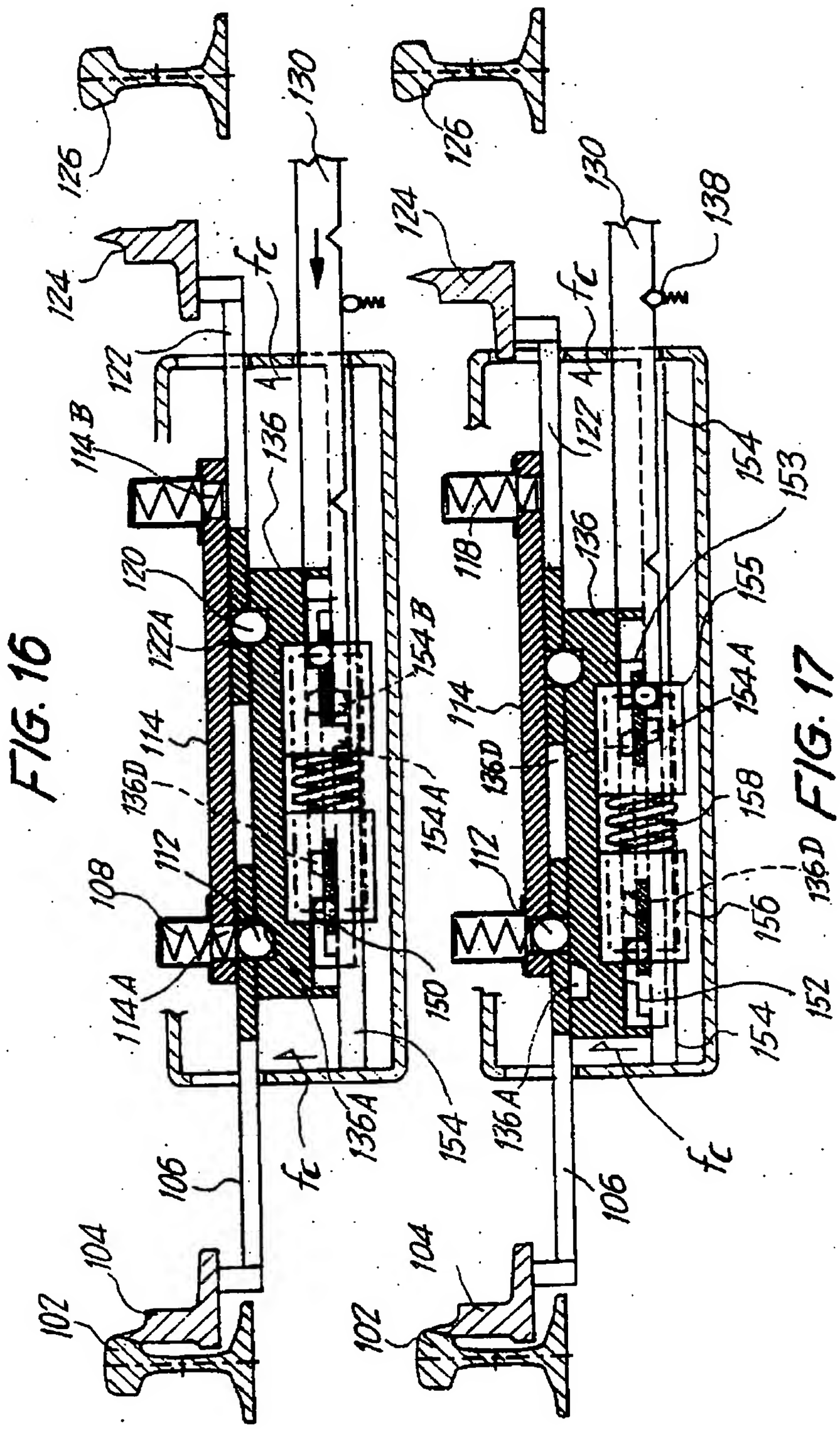

126
130
124
fc
122
114B
136A
120
122A
154B
114
136D
154A
112
108
114A
150
106
104
102
126
130
138
124
fc
122A
154
153
118
136
155
154A
114
136D
158
112
156
136D
154
152
136A
154
106
104
102
fc

FIG. 16

FIG. 17

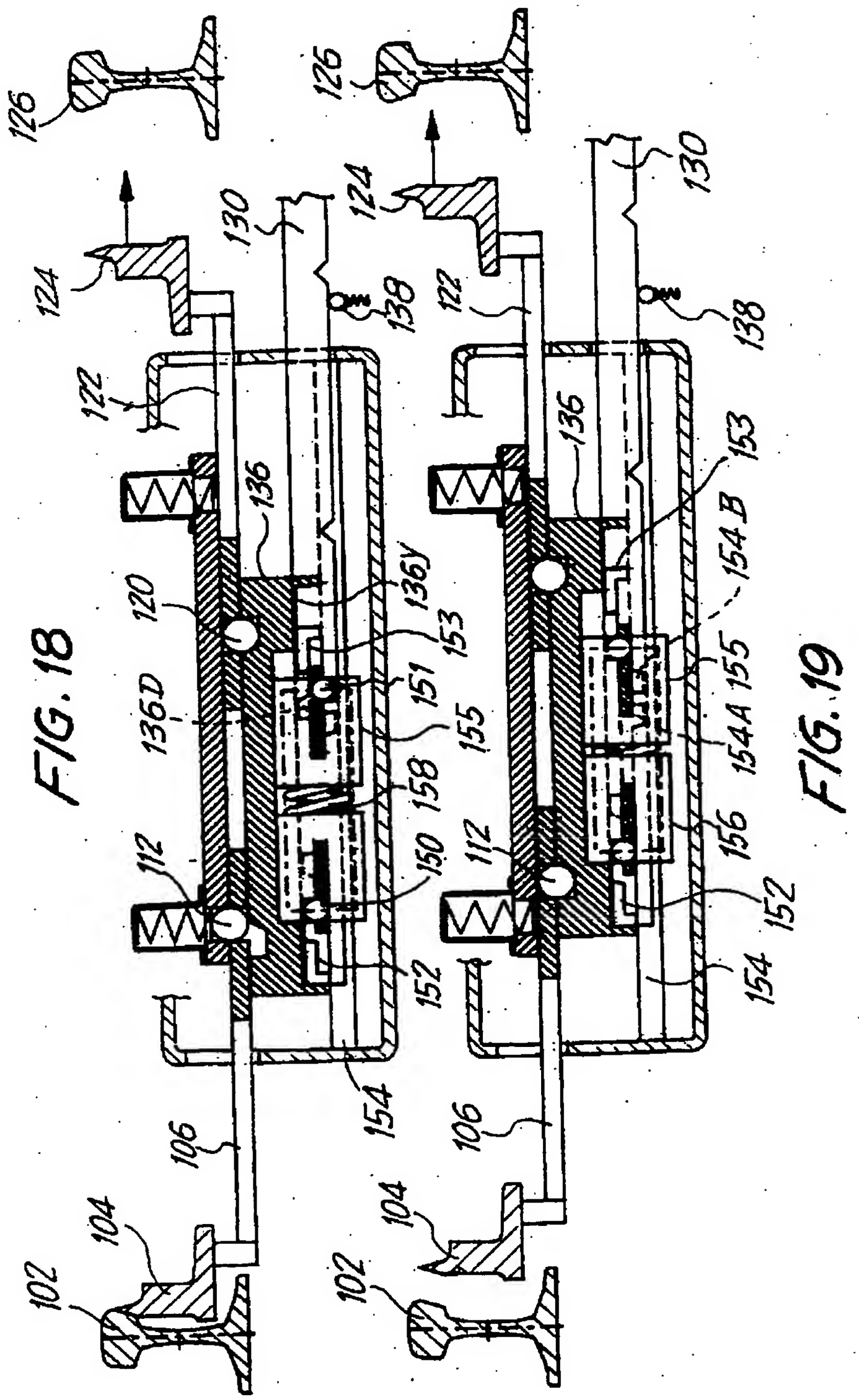

126
126
124
130
124
130
122
138
122
138
136
136
120
136Y
153
153
136D
151
155
155
158
154B
154A
155
156
112
112
150
152
152
154
106
106
104
104
102
102

FIG. 18

FIG. 19

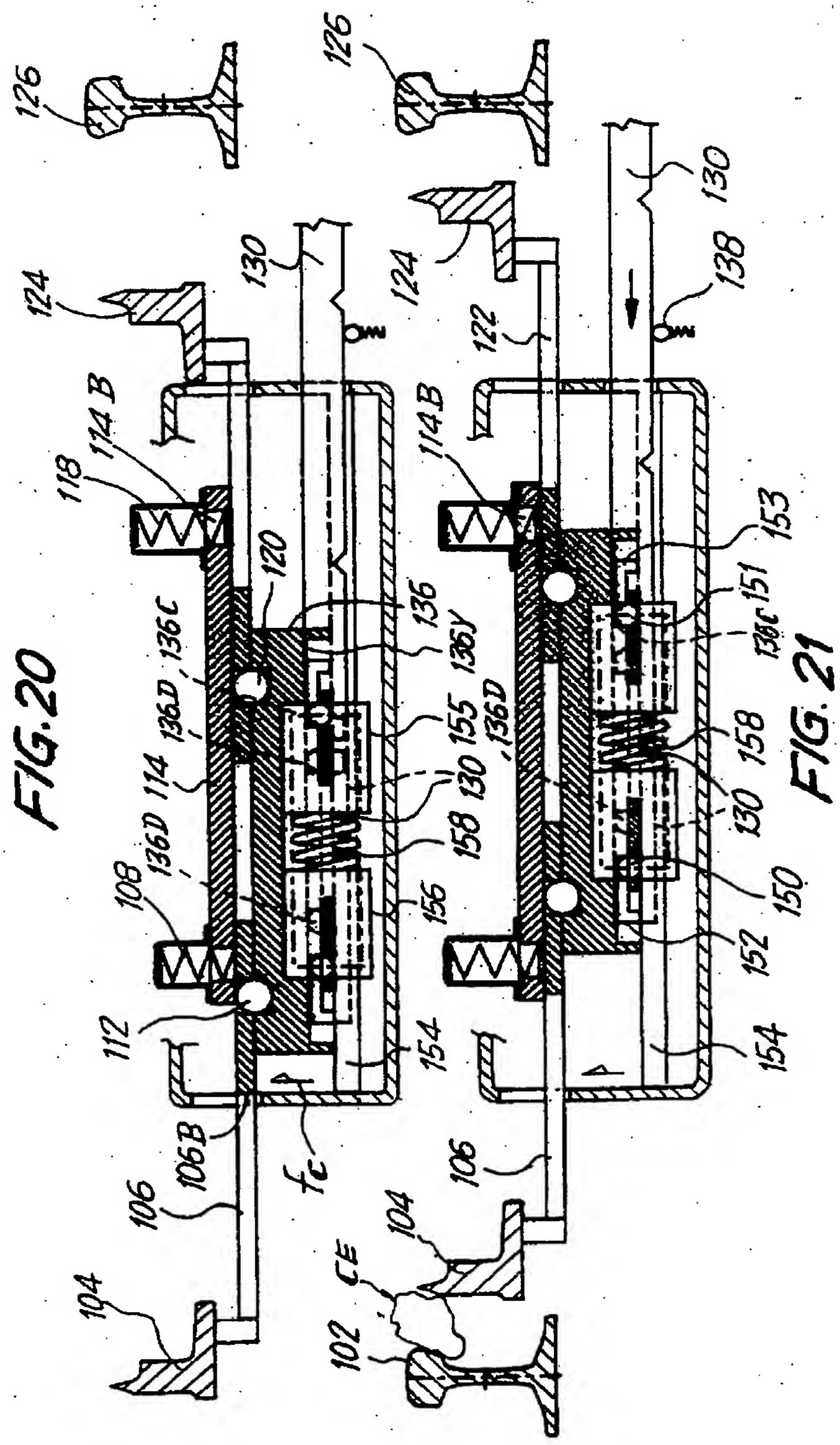
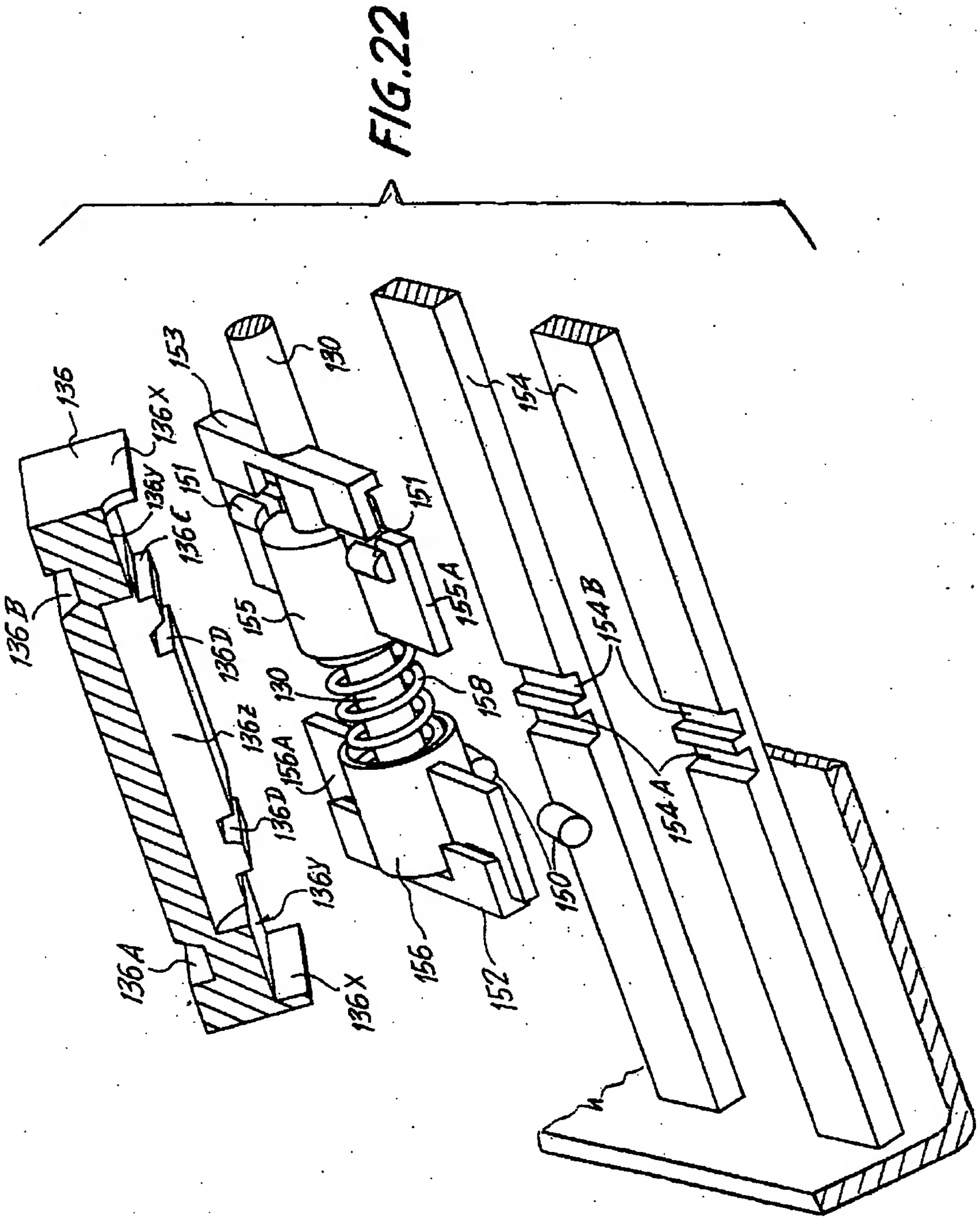

126
126
130
124
124
130
138
122
114B
114B
118
120
136
136C
136D
136Y
136D
155
130
158
114
136D
108
156
158
130
150
152
112
154
154
106B
106
106
fc
104
CE
104
102

FIG. 20

FIG. 21

FIG.22


136
136X
153
130
154
136Y
151
136C
151
136B
155A
154B
136D
155
130
158
136Z
156A
154A
136D
136Y
150
136A
136X
156
152

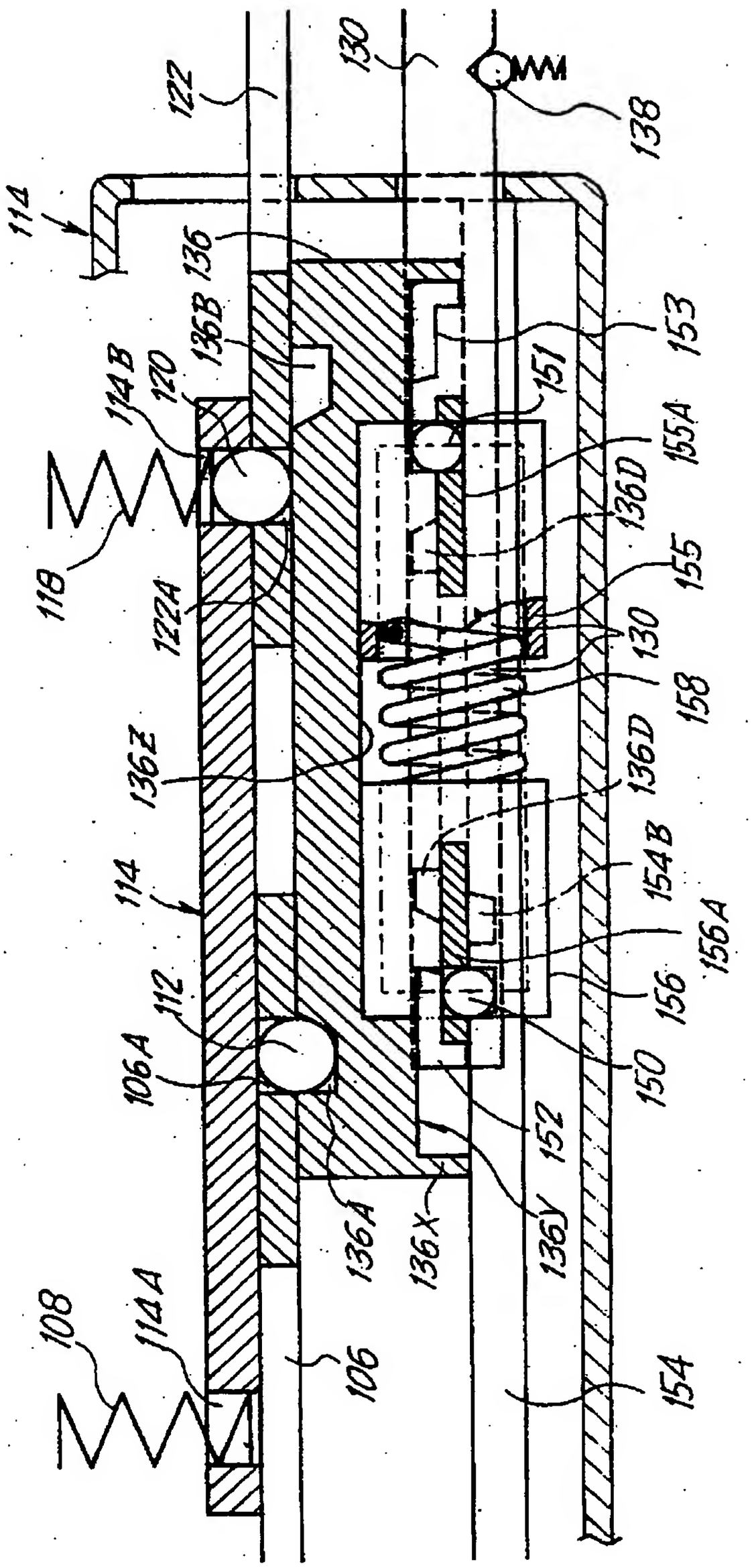

122
130
138
114
136
136B
120
114B
151
153
155A
136D
118
122A
155
130
158
136Z
136D
114
154B
156A
112
156
106A
150
152
136A
136X
136Y
108
114A
106
154

FIG. 23

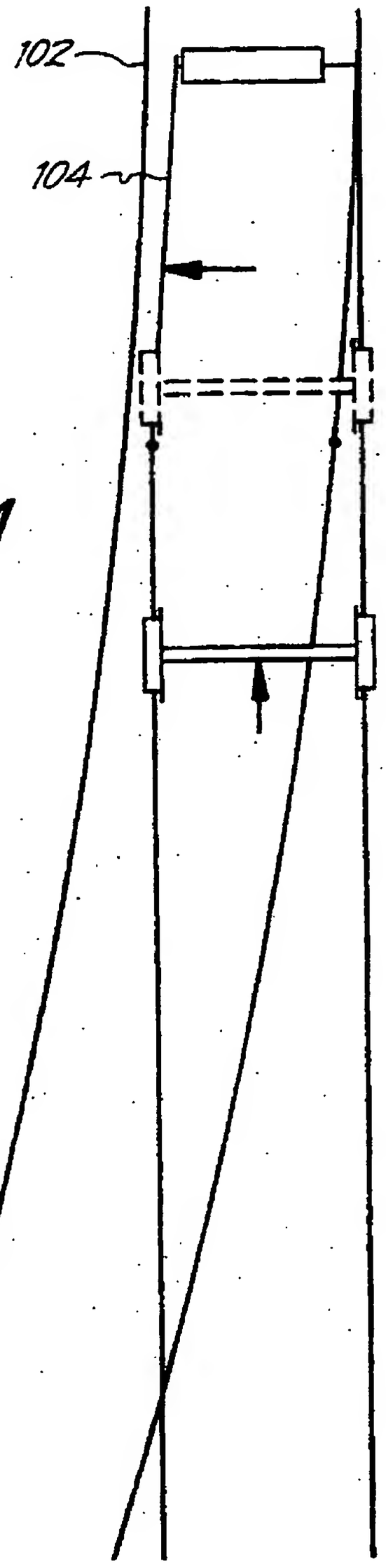


FIG.24

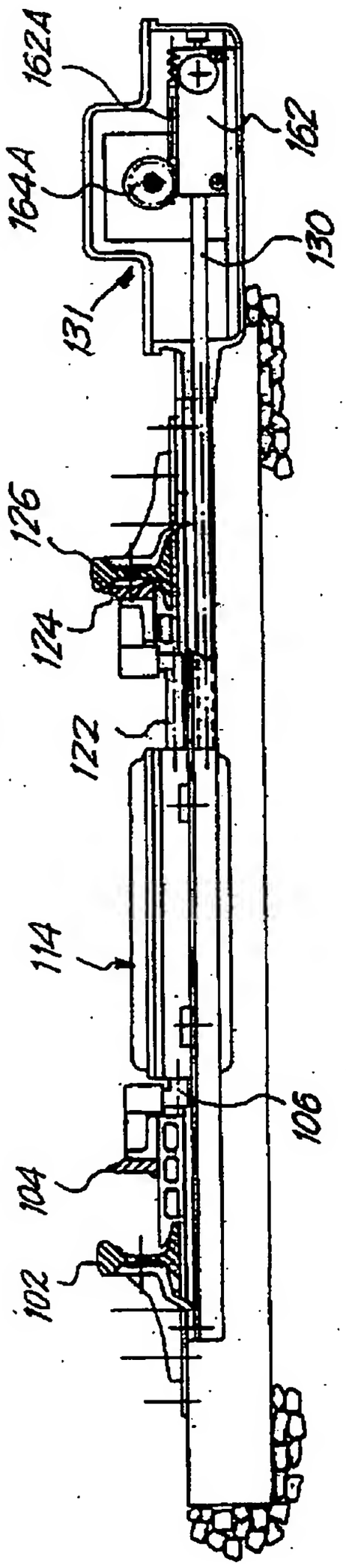

162A
162
164A
130
131
126
124
122
114
106
104
102

FIG. 25

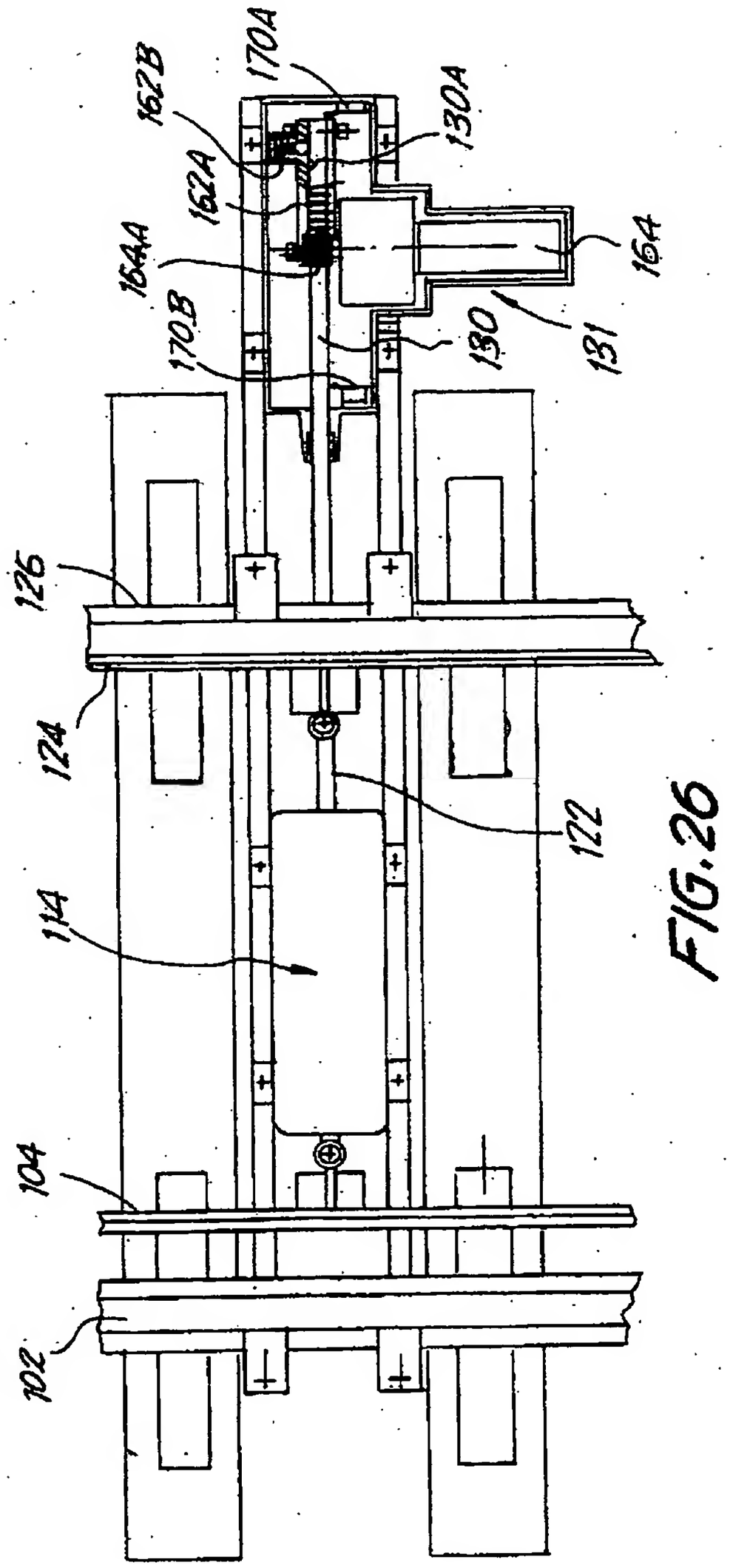

170A
162B
130A
162A
164A
164
170B
130
131
126
124
122
114
104
102

FIG. 26

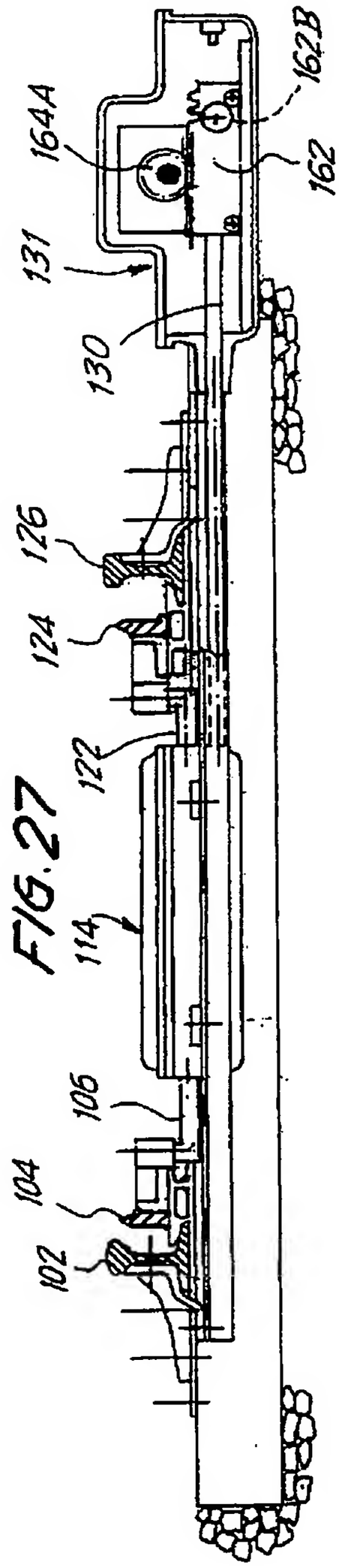

162B
164A
162
131
130
126
124
122
114
106
104
102

FIG.27

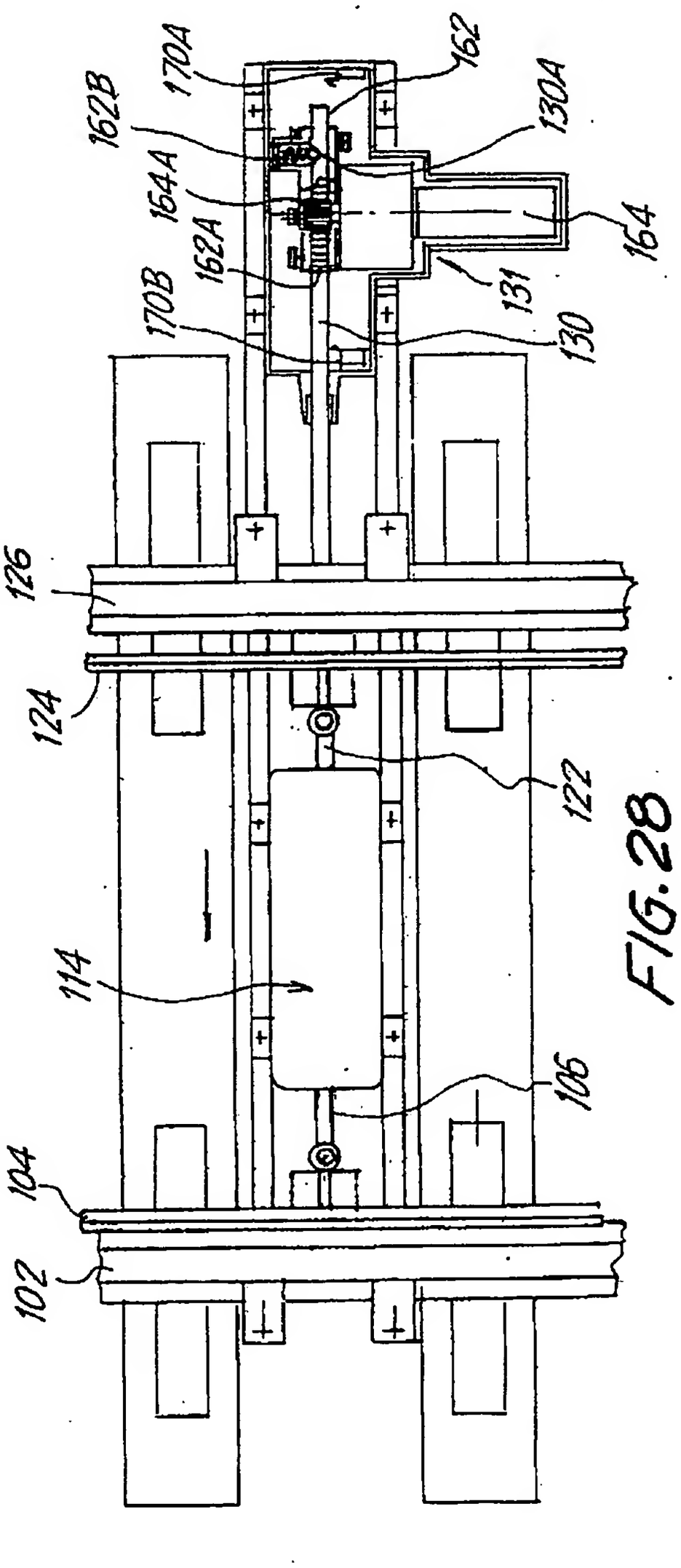

162B
170A
162
130A
164A
164
162A
131
170B
130
126
124
122
114
106
104
102

FIG.28

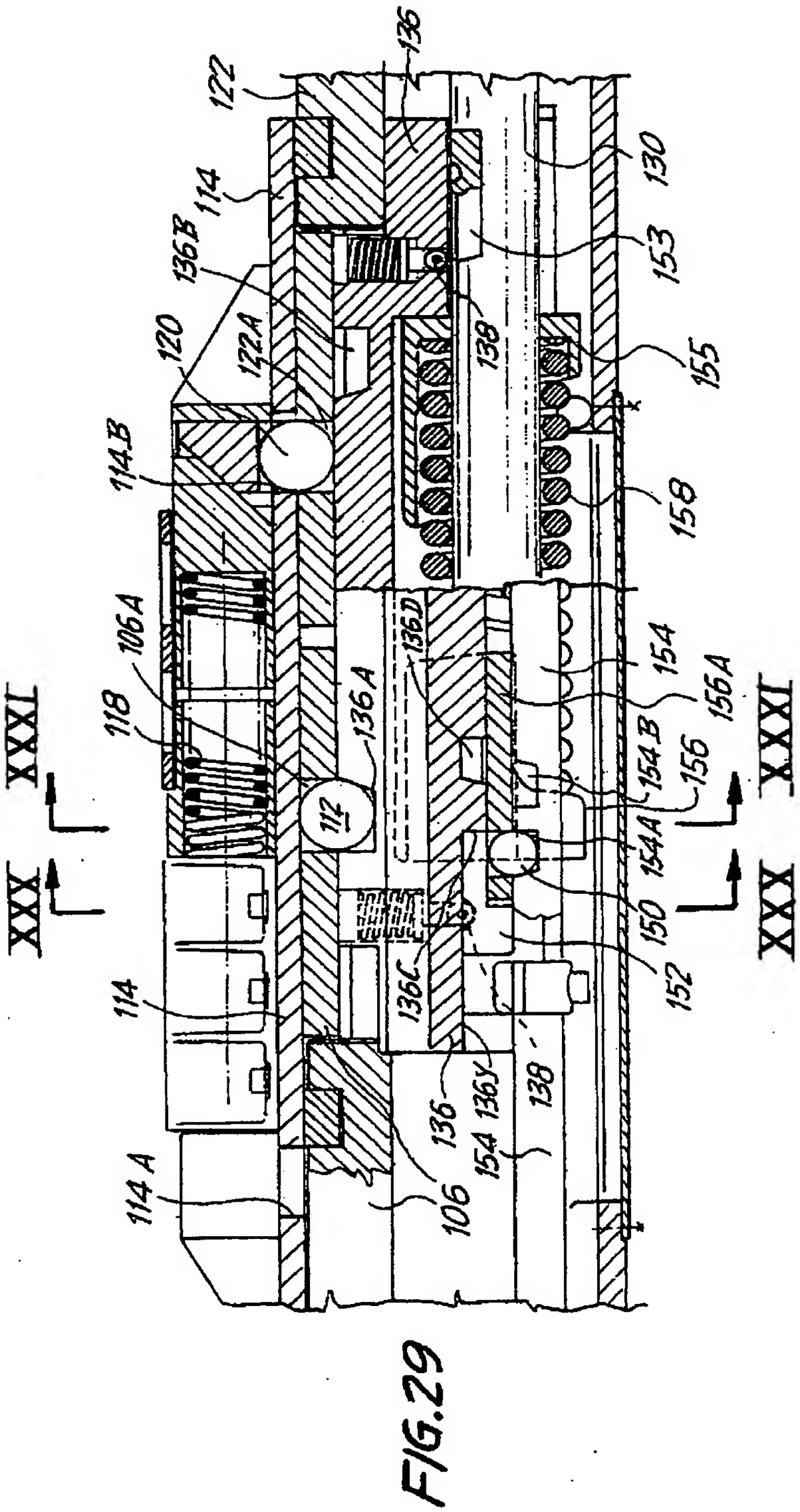

135
122
114
136B
120
122A
114B
106A
118
112
136A
136D
136C
114
114A
106
136
136Y
154
138
138
130
153
155
158
154
156A
154B
156
154A
150
152
XXX
XXXI
XXX
XXXI

FIG.29

FIG. 30

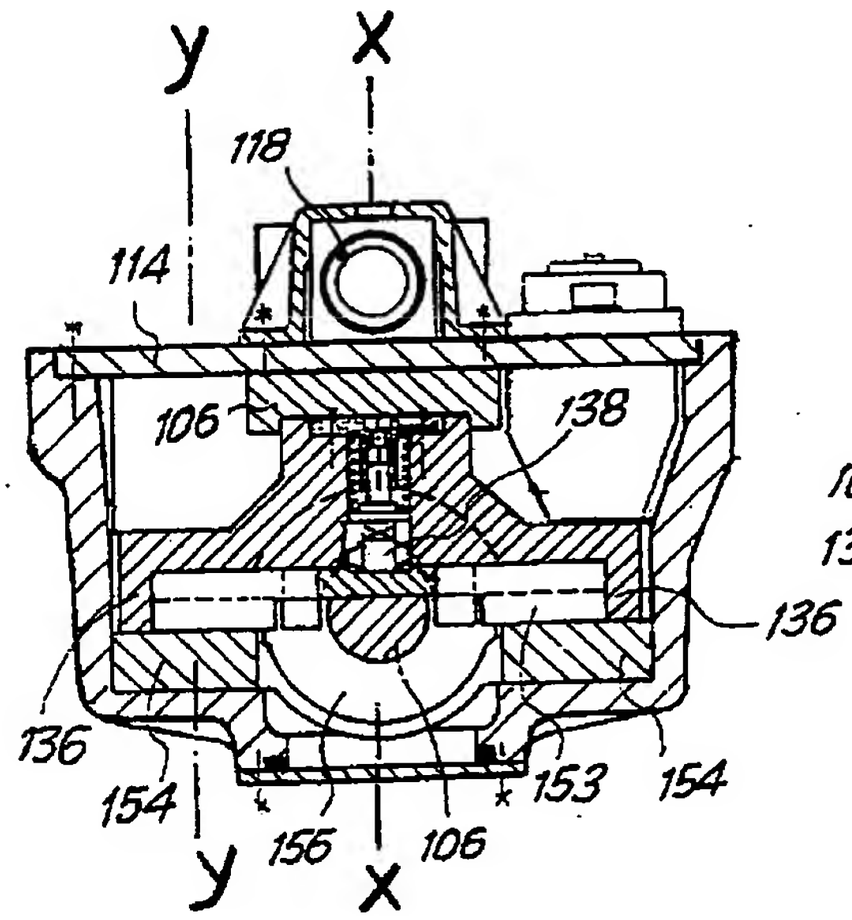
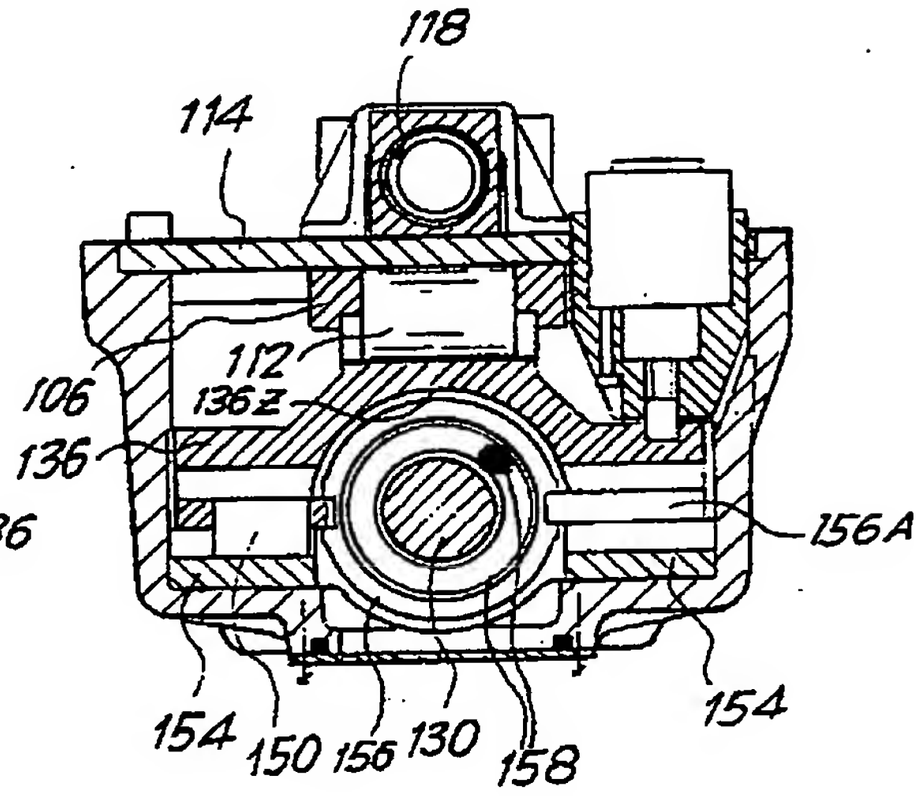


FIG. 31



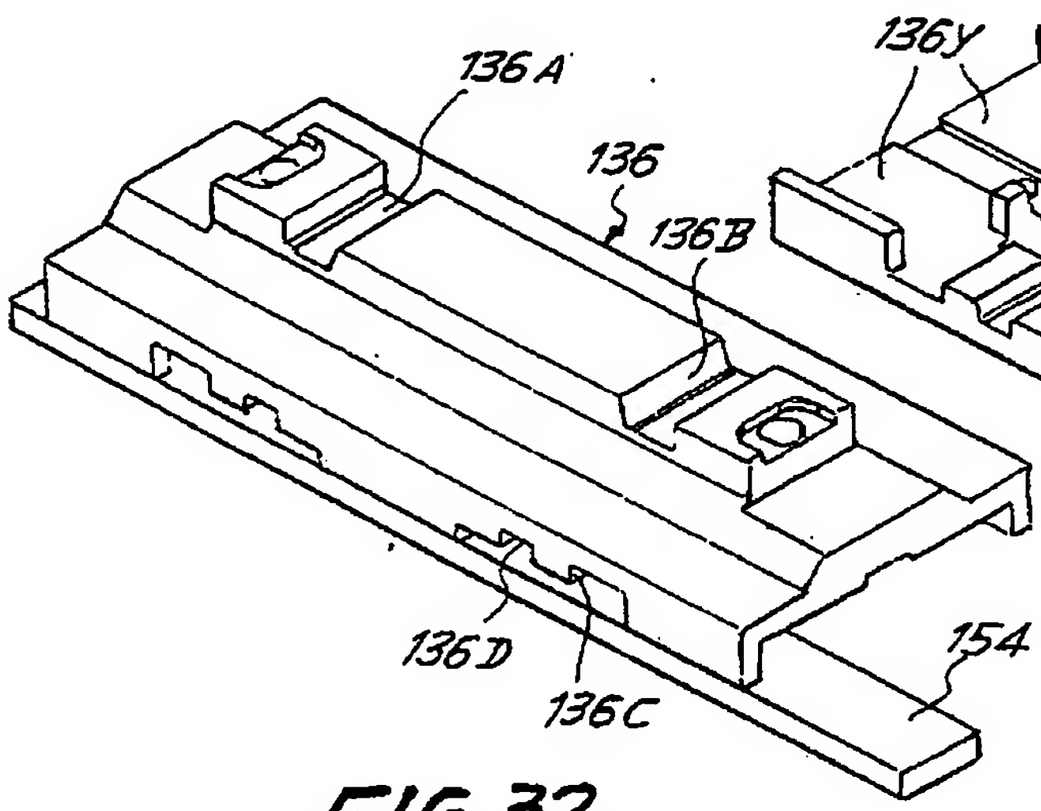


FIG. 32

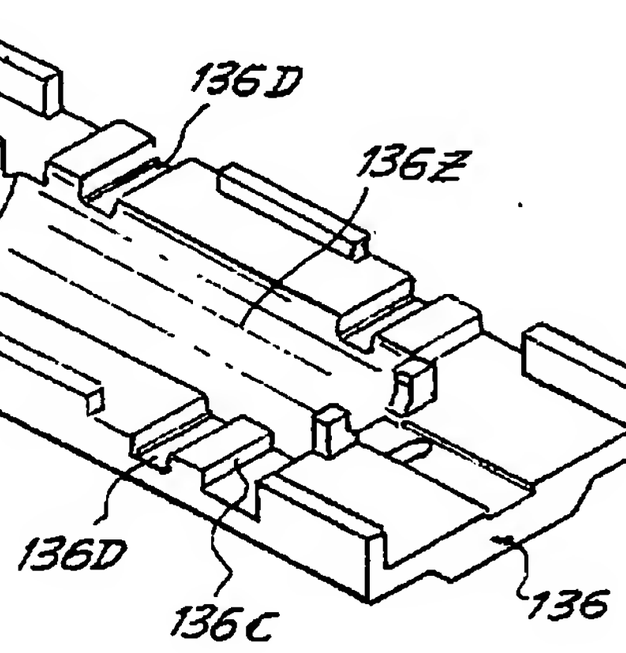


FIG. 33